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| APPLICATION NO.  | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
| 10/594,253   | 09/25/2006  | Shinji Inagaki       | 296761US0PCT        | 7399             |
| 22850  | 7590        | 05/10/2012           | EXAMINER            |                  |
| OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, L.L.P.<br>1940 DUKE STREET<br>ALEXANDRIA, VA 22314 |             |                      | BOHATY, ANDREW K    |                  |
|  |             |                      | ART UNIT            | PAPER NUMBER     |
|  |             |                      | 1786                |                  |
|  |             |                      | NOTIFICATION DATE   | DELIVERY MODE    |
|  |             |                      | 05/10/2012          | ELECTRONIC       |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patentdocket@oblon.com  
oblonpat@oblon.com  
jgardner@oblon.com

|                              |                                      |                                       |  |
|------------------------------|--------------------------------------|---------------------------------------|--|
| <b>Office Action Summary</b> | <b>Application No.</b><br>10/594,253 | <b>Applicant(s)</b><br>INAGAKI ET AL. |  |
|                              | <b>Examiner</b><br>ANDREW K. BOHATY  | <b>Art Unit</b><br>1786               |  |

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 25 November 2011.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on \_\_\_\_; the restriction requirement and election have been incorporated into this action.
- 4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 5) ☒ Claim(s) 1-5, 10, 11 and 15-27 is/are pending in the application.
- 5a) Of the above claim(s) 15, 19 and 20 is/are withdrawn from consideration.
- 6) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 7) ☒ Claim(s) 1-5, 10, 11, 16-18 and 21-26 is/are rejected.
- 8) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 9) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 10) ☐ The specification is objected to by the Examiner.
- 11) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 12) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948)                        | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date ____. | 6) <input type="checkbox"/> Other: ____.  |

## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on November 25, 2011 has been entered.

2. This Office action is in response to the amendment filed October 28, 2011, which amends claims 1 and 19 and adds claim 27. Claims 1-5, 10, 11, and 15-27 are pending, where claims 15, 19, and 20 are withdrawn from consideration.

### ***Response to Arguments***

3. Applicant's arguments filed October 28, 2011 have been fully considered but they are not persuasive.

4. The rejections of claims 1-5, 10, and 11 under 35 U.S.C. 103(a) as being unpatentable over Shea et al. (Chem. Mater. 1989, 1, 572-574) in view of Bartl et al. (Chem. Commun. 2002, 2474-2475), claims 16 and 18 under 35 U.S.C. 103(a) as being unpatentable over Shea et al. (Chem. Mater. 1989, 1, 572-574) in view of Bartl et al. (Chem. Commun. 2002, 2474-2475), Mashita et al. (JP 2000-306669) (hereafter "Mashita"), and Corriu et al. (Chem. Commun. 1996, 1845-1846), claim 17 under 35 U.S.C. 103(a) as being unpatentable over Shea et al. (Chem. Mater. 1989, 1, 572-574)

Art Unit: 1786

in view of Bartl et al. (Chem. Commun. 2002, 2474-2475) and Ogawa (J. Am. Chem. Soc. 1994, 116, 7941-7942), Claims 1-5, 10, 11, 21, 22, and 24-26 under 35 U.S.C. 103(a) as being unpatentable over Loy et al. (Chem. Rev. 1995, 95, 1431-1442) in view of Dunn et al. (J. Mater. Chem. 1991, 1, 903-913) and Bartl et al. (Chem. Commun. 2002, 2474-2475), and claim 23 under 35 U.S.C. 103(a) as being unpatentable over Loy et al. (Chem. Rev. 1995, 95, 1431-1442) in view of Dunn et al. (J. Mater. Chem. 1991, 1, 903-913), Bartl et al. (Chem. Commun. 2002, 2474-2475), and Jones et al. (US 6,682,810) as set forth in the Office action mailed June 30, 2011 are maintained.

5. Regarding the applicant's argument that none of the prior art references do not teach the presence of an additional luminescent material in the pores of the mesoporous material and/or adhered on the walls of the pores, the examiner points out that Bartl teaches the dye dopant is found in the hydrophobic portion of the mesoporous silica, which in the surfactant (page 2474 left column second full paragraph). Bartl also teaches the surfactant is found in the pores of the mesoporous silica; therefore, the luminescent material of Bartl is found in the pores of the mesoporous silica. This teaching by Bartl shows that the applicant's argument is not persuasive.

6. Furthermore, the examiner points to Scott et al. (Chem. Mater. 2001, 13, 3140-3150) (hereafter "Scott"), which Bartl references. Scott teaches when luminescent material are added to mesoporous silica the luminescent material is found in the pores of the mesoporous silica and is also found adhered to the walls of the pores (pages 3141-3142 paragraphs under the heading Early Work: Dye Inclusion and page 3143 paragraphs under the heading Organometallic Complexes). Therefore, the mesoporous

materials of Shea 1989 in view of Bartl would have taught the presence of the additional luminescent material in the both pores and adhered to the walls of pores of the mesoporous silica. This shows the applicant's argument is not persuasive.

### ***Claim Rejections - 35 USC § 103***

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

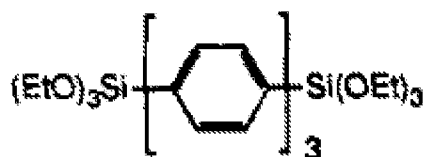
8. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

9. Claims 1-5, 10, 11, and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shea et al. (Chem. Mater. 1989, 1, 572-574) (hereafter "Shea 1989") in view of Bartl et al. (Chem. Commun. 2002, 2474-2475) (hereafter "Bartl") as referenced by Scott et al. (Chem. Mater. 2001, 13, 3140-3150) (hereafter "Scott").

Art Unit: 1786

10. Regarding claims 1-3, 10, 11, and 27, Shea 1989 discloses a siloxane polymer



made from the following monomer, , (573 left column, scheme in the middle of the page, paragraph 1, compounds 3a and 3z) which reads on formula (1) in claim 1, where X is benzene (an applicants' preferred fluorescent molecule that can be excited by light),  $\text{R}^1$  is ethoxy (claim 2), n is 3 and m is 2 (claim 3). Shea 1989 does teach the use of the siloxane polymers in optics (page 574 left column paragraph 2).

11. Shea 1989 does not teach wherein the porous siloxane polymer comprises another luminescent compound, where that compound is phosphorescent and the compound is "adsorbed on", "bonded to", "filled in" or "mixed with" the polymer, and wherein the siloxane polymer with the additional luminescent compound further comprises a surfactant.

12. Bartl teaches the encapsulation of rare earth material complexes in sol-gel derived composites (page 2474 left column paragraph 1). Bartl teaches the sol-gel derived composites include mesoporous silica and these materials are used for their optical properties (page 2472 left column paragraph 2). Bartl teaches the rare earth metals compounds to be Eu and Tb containing (page 2474 left column 2 paragraph), which are well known phosphorescent compounds (claim 11). Bartl teaches that when the phosphorescent rare earth metal complexes are mixed with the siloxane polymer and the polymer made further comprises a surfactant (P123) (claim 10) (page 2474 left

Art Unit: 1786

column paragraph 3). Bartl teaches when a surfactant is present the size of the pores in the mesoporous structure is around 4 nm (page 2474 Fig. 1). Bartl further teaches that the light emitted from the mesoporous structure is more pure than light emitted from sol-gels that do not have the mesoporous structure (page 2475 left column last paragraph).

13. Scott teaches when dopants are added to mesoporous silica the dopants are found in the pore further be adhered to the walls of the pores (pages 3141-3142 paragraphs under the heading Early Work: Dye Inclusion and page 3143 paragraphs under the heading Organometallic Complexes). This shows that the dye used in Bartl would be found both in the pores and on the surface of the pore walls.

14. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the siloxane polymer of Shea 1989, so when the polymer was made the synthesis included a surfactant and a rare earth metal compound (phosphorescent material), so the resulting polymer contained an additional phosphorescent compound mixed with the polymer and the polymer further comprised a surfactant and the size of the pores is around 4 nm. The motivation would have been to make a siloxane polymer structure that emits light with a higher purity. Both Shea 1989 and Bartl teach the use of their sol-gels for use in optics, while Bartl teaches the incorporation of phosphorescent materials into the sol-gel network and that mesoporous structure displays better light purity than other mesoporous structures. The phosphorescent material would be found both in the pore and adhered on the pore walls.

15. Regarding claim 4, although Shea 1989 does not specifically disclose wherein the difference in energy between the ground state and any of a singles excited state and a triplet excited is 40 to 140 kcal/mol the siloxane polymer from above inherently has this property. Also, the above siloxane polymer/monomer is an example of the applicants which contain this property (applicant's Ph-Si). Furthermore, the claimed properties would naturally flow from combination of Shea 1989 and Bartl.

16. Regarding claim 5, Shea 1989 discloses the siloxane polymer (page 573 compound 3z) using the above monomer has a structure with a regular spaced array by introduction of the organic spacer (benzene molecule) (page 572, right column paragraph 2, Figure 2). Since the monomer is a benzene ring the period would be less than 5 nm, because benzene has a length smaller than 5 nm.

17. Claims 16 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shea et al. (Chem. Mater. 1989, 1, 572-574) (hereafter "Shea 1989") in view of Bartl et al. (Chem. Commun. 2002, 2474-2475) (hereafter "Bartl") as applied to claims 1-5, 10, 11, and 27 above, and further in view of Mashita et al. (JP 2000-306669) (hereafter "Mashita"), where machine translation is used as English equivalent, and Corriu et al. (Chem. Commun. 1996, 1845-1846) (hereafter "Corriu").

18. Regarding claims 16 and 18, Shea 1989 in view of Bartl does not teach wherein the siloxane polymer further comprises an electric charge transporting material. Shea 1989 does not teach a film with a thickness be 1  $\mu\text{m}$  or less.



Art Unit: 1786

19. Mashita teaches a sol-gel (siloxane polymer) comprising a luminescent material and an electron transporting material (paragraph [0067]). Mashita teaches the use of the sol-gel in electroluminescent devices (paragraph [0011]). Mashita teaches the thickness of the layer comprising the sol-gel layer is preferably 0.5  $\mu\text{m}$  or less (paragraph [0037]), and shows in the examples the layer can be 110 nm (paragraph [0067]). Mashita teaches the mixed sol-gel proved an electroluminescence device that is very efficient and long lifetime (paragraph [0009]).

20. Corriu teaches the use of bridged siloxane polymers can be used in light emitting diodes (page 1845 left column first three paragraphs).

21. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the siloxane polymer of Shea 1989 in view of Bartl to include an electron transporting material in the polymer and use the material in an electroluminescent device, where the thickness of the film is 0.5  $\mu\text{m}$  or less. Mashita teaches the use of sol-gel in electroluminescent devices, while Corriu teaches that bridged siloxane polymers could be used in light emitting devices and Shea 1989 teaches the use of bridged siloxane polymers comprising of that benzene molecule as the bridging component. The motivation would have been to produce a siloxane polymer that could be used in a light emitting device and be very efficient and have a long lifetime.

22. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shea et al. (Chem. Mater. 1989, 1, 572-574) (hereafter "Shea 1989") in view of Bartl et al.

Art Unit: 1786

(Chem. Commun. 2002, 2474-2475) (hereafter "Bartl") as applied to claims 1-5, 10, 11, and 27 above, and further in view of Ogawa (J. Am. Chem. Soc. 1994, 116, 7941-7942) (hereafter "Ogawa").

23. Regarding claim 17, Shea 1989 in view of Bartl does not teach wherein the siloxane polymer is a layered material of stacked nanosheets, where each layer having a thickness of 10 nm or less. Shea 1989 does teach the use of the siloxane polymers in optics (page 574 left column paragraph 2).

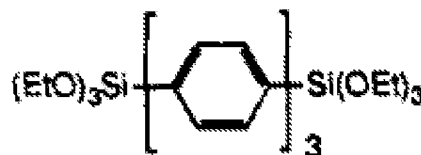
24. Ogawa teaches the synthesis of siloxane polymers that are in a layered structure, where each layer has a thickness of 1 nm (page 7942 left column paragraph 2 Figure 3). Ogawa teaches films are highly transparent in the wavelengths of 220 to 2000 nm (page 7942 right column paragraph 3).

25. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the siloxane polymers of Shea 1989 in view of Bartl, so siloxane polymer was in a stacked structure of nanosheets, where the thickness of each layer was 1 nm. The motivation would have been to form a film that was highly transparent in the wavelengths of 220 to 2000 nm.

26. Claims 1-5, 10, 11, 21, 22, and 24-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Loy et al. (Chem. Rev. 1995, 95, 1431-1442) (hereafter "Loy") in view of Dunn et al. (J. Mater. Chem. 1991, 1, 903-913) (hereafter "Dunn") and Bartl et al. (Chem. Commun. 2002, 2474-2475) (hereafter "Bartl") as reference by Scott et al. (Chem. Mater. 2001, 13, 3140-3150) (hereafter "Scott").

Art Unit: 1786

27. Regarding claims 1-3, 10, 11, 21, 22, 24, 26, and 27, Loy discloses a siloxane



polymer made from the following monomer, (1435 left

column, Figure 11) which reads on formula (1) in claim 1, where X is benzene (an applicants' preferred fluorescent molecule that can be excited by light), R<sup>1</sup> is ethoxy (claim 2), n is 3 and m is 2 (claim 3). Loy discloses that siloxane polymer is porous and the mean pore diameter is 2 nm or smaller (573 right column, paragraph 1). Loy does teach the use of the siloxane polymers in optics (page 1441 left column paragraph after heading B. Optical Applications).

28. Loy does not teach wherein the porous siloxane polymer comprises another luminescent compound, where that compound is phosphorescent and the compound is "adsorbed on", "bonded to", "filled in" or "mixed with" the polymer, and wherein the siloxane polymer with the additional luminescent compound further comprises a surfactant.

29. Dunn teaches the doping of sol-gel material with different organic molecules (abstract). Dunn teaches doping sol-gel materials with different organic molecules, such as fluorescent and phosphorescent dopants, one can change the optical properties of the material (page 910 left column third full paragraph). Dunn teaches one can tune the color of the emission of the optical material (page 910 right column last paragraph). Dunn teaches a variety of different dopants can be added to the material, such as Rhodamine 6G, and any known light emitting dopant can be added to material

Art Unit: 1786

(page 910 paragraphs under heading Sol-Gel Lasers and page 911 Table 2). Dunn teaches the amount of the fluorescent dopant can range from about 2% to 40% and teaches Rhodamine 6G can be about 40% of the sol-gel material (page 910 paragraphs under heading Sol-Gel Lasers).

30. Bartl teaches sol-gel derived composites including mesoporous silica and these materials are used for their optical properties (page 2472 left column paragraph 2).

Bartl teaches the mesoporous silica is made by adding a surfactant to the reaction comprising the sol-gel material and the light emitting dopant (claim 10) (page 2474 left column paragraph 3). Bartl teaches when a surfactant is present the size of the pores in the mesoporous structure is around 4 nm (page 2474 Fig. 1). Bartl further teaches that the light emitted from the mesoporous structure is more pure than light emitted from sol-gels that do not have the mesoporous structure (page 2475 left column last paragraph). Bartl also teaches that the energy emitted from one dopant can be used to excite the other dopant found in the sol and lead to the second compound emitting light at a different wavelength (page 2475 left column last paragraph).

31. Scott teaches when dopants are added to mesoporous silica the dopants are found in the pore further be adhered to the walls of the pores (pages 3141-3142 paragraphs under the heading Early Work: Dye Inclusion and page 3143 paragraphs under the heading Organometallic Complexes). This shows that the dye used in Bartl would be found both in the pores and on the surface of the pore walls.

32. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the siloxane polymer of Loy, so when the polymer was

Art Unit: 1786

made the synthesis included a surfactant and an additional fluorescent or phosphorescent dopant, so the resulting polymer contained an additional fluorescent or phosphorescent compound, in the amount of around 40%, mixed with the polymer and the polymer further comprised a surfactant and the size of the pores is around 4 nm.

The motivation to add the additional fluorescent or phosphorescent material would have been to change the optical properties of the sol-gel material. The motivation to add the surfactant would have been to make a siloxane polymer structure that emits light with a higher purity. The phosphorescent material would be found both in the pore and adhered on the pore walls.

33. Regarding claim 4, although Loy does not specifically disclose wherein the difference in energy between the ground state and any of a singles excited state and a triplet excited is 40 to 140 kcal/mol the siloxane polymer from above inherently has this property. Also, the above siloxane polymer/monomer is an example of the applicants which contain this property (applicant's Ph-Si). Furthermore, the claimed properties would naturally flow from combination of Loy, Dunn, and Bartl.

34. Regarding claim 5, Loy discloses the siloxane polymer (page 1435 Figure 11) using the above monomer has a structure with a regular spaced array by introduction of the organic spacer (benzene molecule). Since the monomer is a benzene ring the period would be less than 5 nm, because benzene has a length smaller than 5 nm.

35. Regarding claim 25, the limitation would naturally flow from the combination of Loy, Dunn, and Bartl. Furthermore, Bartl shows that is well known in the art that the emission energy from one light emitting material can be absorbed by another light

Art Unit: 1786

emitting compound causing the second light emitting compound to emit light at a different wavelength than the wavelength absorbed (page 2475 left column last paragraph).

36. Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Loy et al. (Chem. Rev. 1995, 95, 1431-1442) (hereafter "Loy") in view of Dunn et al. (J. Mater. Chem. 1991, 1, 903-913) (hereafter "Dunn") and Bartl et al. (Chem. Commun. 2002, 2474-2475) (hereafter "Bartl") as applied to claims 1-5, 10, 11, 21, 22, and 24-27 above, and further in view of Jones et al. (US 6,682,810) (hereafter "Jones").

37. Regarding claim 23, Loy in view of Dunn and Bartl does not teach where the added fluorescent material is an aluminum porphyrin complex. Dunn does teach that any fluorescent material can be added to sol-gel (page 910 paragraphs under heading Sol-Gel Lasers and page 911 Table 2).

38. Jones teaches fluorescent material (abstract). Jones teaches a variety of different fluorescent materials that can be used for optical materials and teaches aluminum porphyrin complexes as a type of fluorescent material (column 7 lines 59-67 and column 8 lines 1-37).

39. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use an aluminum porphyrin complex as the additional fluorescent material. The motivation would have been to modify the optical properties of the sol-gel material, so the material emitted red light and adding the aluminum porphyrin complex would do this.

***Conclusion***

40. Any inquiry concerning this communication or earlier communications from the examiner should be directed to ANDREW K. BOHATY whose telephone number is (571)270-1148. The examiner can normally be reached on Monday through Thursday 8:00 am to 5:30 pm EST and every other Friday from 8:00 am to 4:30 pm EST.

41. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jennifer Chriss can be reached on (571)272-7783. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

42. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/A. K. B./  
Andrew K. Bohaty  
Examiner, Art Unit 1786

/Lynda M Salvatore/

Application/Control Number: 10/594,253

Page 15

Art Unit: 1786

Primary Examiner, Art Unit 1786